* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the charge circuit which charges a rechargeable battery.
[0002]
[Description of the Prior Art]The switching power supply unit which switches the DC power supply conventionally obtained by rectifying and smoothing a commercial alternating current, for example by about 100-kHz high frequency, and changed it into desired voltage efficient with the transformer is used widely.
[0003]As a control system of the output voltage in the above-mentioned switching power supply unit, The Pulse-Density-Modulation (PWM:Pulse Width Modulation) control system which controls the duty ratio of a switching pulse according to change of output voltage, a frequency control system, a phase control system which control the frequency and the phase of a switching pulse, etc. are adopted.
[0004]Drawing 3 shows the fundamental circuitry of the power supply circuit currently conventionally used as an AC adapter / charger 100.
[0005]The AC adapter / charger 100 shown in this drawing 3 are provided with the AC rectification part 2 connected to the commercial power input terminal 1, and the primary coil 10A of the converter transformer 10 is connected to this AC rectification part 2 via the switching element 5.
[0006]The rectification smoothing circuit 20 which consists of the diode 21 and the capacitor 22 is connected to the secondary coil 10B of the above-mentioned converter transformer 10. And while the secondary voltage control part 24 is connected, the output terminals 25A and 25B are connected to this rectification smoothing circuit 20.
[0007]This AC adapter / charger 100 are the switching power supply of a Pulse-Density-

Modulation (PWM:Pulse Width Modulation) method, It has PWM controlling circuit 6 which carries out PWM control of the switching operation of the above-mentioned switching element 5 according to the control output of the above-mentioned secondary voltage control part 24.
[0008]While starting current is supplied to above-mentioned PWM controlling circuit 6 from the bootstrap circuit which is not illustrated, the 3rd output obtained from the 3rd coil 10C of the above-mentioned converter transformer 10 is supplied to a power supply terminal via the diode 7. The control output of the above-mentioned secondary voltage control part 24 is supplied to above-mentioned PWM controlling circuit 6 via the photocoupler 11.
[0009]In such the AC adapter / a charger 100 of composition. If rectification and the DC power supply which carried out smoothness are outputted by the above-mentioned AC rectification part 2, the AC power supply (AC input) supplied from the commercial power input terminal 1, Starting current is supplied to PWM controlling circuit 6 from the bootstrap circuit which is driven by these DC power supply and which is not illustrated, and above-mentioned PWM controlling circuit 6 starts oscillation operation on the frequency which is about 100 kHz. According to the switching current which the switching element 5 performs switching operation by the oscillation output of above-mentioned PWM controlling circuit 6, and flows into the primary coil 10A of the above-mentioned converter transformer 10 from the above-mentioned AC rectification part 2. The secondary coil 10B and the 3rd coil 10C of the above-mentioned converter transformer 10 are made to induce a secondary output and the 3rd output.
[0010]Thus, the 3rd output obtained by the 3rd coil 10C of the above-mentioned converter transformer 10 is used as a driving source of above-mentioned PWM controlling circuit 6.
[0011]The secondary output obtained by the secondary coil 10B of the above-mentioned converter transformer 10 is supplied to the load of a rechargeable battery or VTR via the output terminals 25A and 25B while it is carried out by the rectification smoothing circuit 20 as for rectification and smoothness and is used as a driving source of the above-mentioned secondary voltage control part 24.
[0012]By the above-mentioned secondary voltage control part's 24 detecting the voltage of rectification and the dc output by which smoothness was carried out via the voltage detecting resistances 23 by the above-mentioned rectification smoothing circuit 20, and comparing with the reference voltage Vref, Error voltage is obtained and the control output according to this error voltage is returned to above-mentioned PWM controlling circuit 6 via the photocoupler 11.

[0013]Above-mentioned PWM controlling circuit 6 carries out PWM control of the switching operation of the above-mentioned switching element 5 by changing the pulse width of an oscillation output according to the above-mentioned control output, i.e., the error voltage, which return from the above-mentioned secondary voltage control part 24.
[0014]By carrying out PWM control of the switching operation of the above-mentioned

switching element 5, the dc output voltage (example: Vo=8.4V) supplied to a rechargeable battery or load via the output terminals 25A and 25B from the above-mentioned rectification smoothing circuit 20 can be stabilized.

[0015]By the way, in the AC adapter / charger 100 shown in drawing 3, when an AC input occurs, secondary-side-output-voltage Vo=8.4V is outputted via the output terminals 25A and 25B, and the load of charge of a rechargeable battery or VTR is driven.

[0016]However, when there is no AC input (state which pulled out AC power Takeshi or an AC plug from the electric socket), When the output from the diode 21 of the above-mentioned rectification smoothing circuit 20 is lost, back run current flows into the secondary voltage control part 24 from the rechargeable battery connected to the above-mentioned output terminals 25A and 25B, and a rechargeable battery will be discharged, if a long time is covered and the state continues.

[0017]In order to avoid this problem, as shown in drawing 4, in the former, the rectification smoothing circuit 20 which consists of the above-mentioned diode 21 and the capacitor 22 independently, Since the above-mentioned secondary voltage control part 24 drove, he forms the rectification smoothing circuit 30 which consists of the diode 31 and the capacitor 32, or was trying to insert the diode 35 for prevention of backflow in the power supply line to a rechargeable battery, as shown in drawing 5.

[0018]However, although the back run current from a rechargeable battery can be prevented in conventional AC adapter / charger 110,120 shown in above-mentioned drawing 4 or drawing 5, While driving the load of VTR etc., when load mode passes from a heavy-loading state and changes suddenly to loaded condition, output voltage will become somewhat higher than a programmed voltage (Vo=8.4V) temporarily, the output pulse width of PWM controlling circuit 6 will turn into minimum width, and an oscillation will stop. The 3rd output that is a driving source of PWM controlling circuit 6 is not obtained, but PWM controlling circuit 6 will be in a standby (pause) state, and will await the starting current from the bootstrap circuit which is not illustrated, and a reboot will take the time for about 0.3 second to it. At this time, the output voltage Vo also declines temporarily and produces the fault which serves as a power supply noise to load (VTR).

[0019]In order to prevent quenching of PWM controlling circuit 6 by such a load change conventionally, the output terminal 25A is passed, and he passes the transistor 37 among 25B, and was trying to connect the about 47-ohm dummy resistor 38.

[0020]

[Problem(s) to be Solved by the Invention]However, in the above-mentioned output terminal 25A, and the conventional AC adapter/charger 110,120 which connected the about 47-ohm dummy resistor 38 via the transistor 37 among 25B. Since the above-mentioned transistor 37 is turned on and current is always flowing into the dummy resistor 38 when an AC input

occurs, Even if an AC adapter/charger is waiting states, when the power consumption by the above-mentioned dummy resistor 38 will be continued and power-saving is attained, the power consumption by this dummy resistor 38 poses a problem.

[0021]When there is no AC input in view of the problem in conventional AC adapter / charger 110,120 like ****, while the purpose of this invention prevents the back run current from a rechargeable battery to the secondary voltage control part 24, The power consumption by the dummy resistor 38 for preventing faults, such as quenching of PWM controlling circuit 6 by the load change at the time of a load drive, is lost, and it is in providing the charge circuit of the rechargeable battery it enabled it to reduce the power consumption at the time of standby.

[0022]

[Means for Solving the Problem]This invention is characterized by that a charge circuit which carries out rectification smoothness of the output of a switching regulator, and charges a rechargeable battery comprises:

A voltage detection means which detects voltage between terminals to which the above-mentioned rechargeable battery is connected.

A charging voltage control circuit which controls charge voltages supplied to a rechargeable battery from the above-mentioned switching regulator based on an output of this voltage detection means.

A switch element by which the series connection was carried out to a power supply line of the above-mentioned charging voltage control circuit connected between terminals to which the above-mentioned rechargeable battery is connected.

A switch control means to perform control which makes this switch element switch-on when input power of the above-mentioned switching regulator is one, and is made into non-switch-on when this input power is OFF.

[0023]

[Embodiment of the Invention]Hereafter, it explains in detail, referring to drawings for an embodiment of the invention.

[0024]Drawing 1 is a circuit diagram showing the composition of the charge circuit of the rechargeable battery concerning this invention. This AC adapter / charger 200 as a measure against prevention of backflow by this invention to the AC adapter / charger 100 shown in drawing 3, The transistor 50 is formed in the power supply line which supplies the driving source of the secondary voltage control part 24 as a switch element by which the series connection was carried out, The rectification smoothing circuit 20 which becomes the secondary coil 10B of the above-mentioned converter transformer 10 from the above-mentioned diode 21 and the capacitor 22 of the above-mentioned output line independently, The rectification smoothing circuit 40 which consists of the diode 41 and the capacitor 42 is

connected, and it is made to perform ON-and-OFF control of the above-mentioned transistor 50 by the rectification output by this rectification smoothing circuit 40.

[0025]A collector is connected to the power supply line of the output terminal 25A to which a rechargeable battery is connected, and the emitter is connected to the power supply line of the above-mentioned secondary voltage control part 24 for the transistor 50 as the above-mentioned switch element. Elements, such as a transistor for small signals, a transistor containing resistance, and FET, are used for this transistor 50.

[0026]The rectification smoothing circuit 40 which performs ON-and-OFF control of the above-mentioned transistor 50, While the cathode side of the above-mentioned diode 41 is connected to the base of the above-mentioned transistor 50 via the resistance 51, the cathode side of the above-mentioned diode 41 is connected to the collector side of the above-mentioned transistor 50 via the capacitor 42.

[0027]In the AC adapter / charger 200 of this rechargeable battery, about the same component as the component of the AC adapter / charger 100 shown in said drawing 3, identical codes are attached in drawing 1 and that detailed explanation is omitted.

[0028]In this AC adapter / charger 200, when an AC input occurs, The rectification output Vo by the rectification smoothing circuit 20 which consists of the above-mentioned diode 21 and the capacitor 22 of an output line is obtained, and the load of charge or VTR is driven for the output terminal 25A and the rechargeable battery connected among 25B. The transistor 50 is controlled by the rectification output of the above-mentioned rectification smoothing circuit 40 provided in this state independently [the above-mentioned rectification smoothing circuit 20 of the above-mentioned output line] by the ON state, Rectification output Vo =8.4V by the above-mentioned rectification smoothing circuit 20 of an output line is supplied as a driving source of the above-mentioned secondary voltage control part 24 via the above-mentioned transistor 50.

[0029]Since the oscillation of PWM controlling circuit 6 has stopped when there is no AC input, the rectification output voltage by the above-mentioned rectification smoothing circuit 40 is lost, and the above-mentioned transistor 50 is turned off. Therefore, a power supply line is intercepted by the transistor 50 and the back run current from the rechargeable battery connected among 25B to the output terminal 25A and the secondary voltage control part 24 does not flow through the driving source for the above-mentioned secondary voltage control part 24.

[0030]In the circuitry of the case, when an AC input occurs, rectification output Vo =8.4V by the above-mentioned rectification smoothing circuit 20 is used as a driving source of the above-mentioned secondary voltage control part 24 via the above-mentioned transistor 50, Since the driving current of the current which flows into the above-mentioned conventional dummy resistor flows into the above-mentioned secondary voltage control part 24, also when load

changes suddenly in the state where the load of VTR etc. is driven, there is no fault which the oscillation of PWM controlling circuit 6 stops.

[0031]Namely, the dummy resistor 38 connected between output terminals in the circuitry of the case in order to prevent quenching of PWM controlling circuit 6 by a load change is omissible, Power consumption can be lessened by the power consumption by the dummy resistor 38, and power consumption at the time of standby can be lessened.

[0032]The rectification smoothing circuit 30 provided here in conventional AC adapter / charger 110 shown in above-mentioned drawing 4 in order to prevent the back run current from a rechargeable battery, As opposed to needing about [10micro-F/10V] capacity as the capacitor 32 which supplies the power supply for a drive to the secondary voltage control part 24, and is used for the above-mentioned rectification smoothing circuit 30, The rectification output of the rectification smoothing circuit 40 provided independently [the rectification smoothing circuit 20] in the circuitry of the case, Since it is for performing ON-and-OFF control of the above-mentioned transistor 50, the capacitor of the small capacity not more than 0.1micro-F/50V can be used as the constituting-above-mentioned rectification smoothing circuit 40 capacitor 42.

[0033]The prevention-of-backflow diode 35 provided in an output line like conventional AC adapter / charger 120 shown in above-mentioned drawing 5, The big current which flows into an output line to approving in the circuitry of the case. Since the rectification smoothing circuit 20 is for the rectification output of the rectification smoothing circuit 40 provided independently performing ON-and-OFF control of the above-mentioned transistor 50, the diode for small currents can be used as the constituting-above-mentioned rectification smoothing circuit 40 diode 41.

[0034]Thus, in the circuitry of the case, since the rectification smoothing circuit 40 can be constituted from the diode 41 for small currents, and the capacitor 42 of small capacity, while being able to use a chip and attaining space-saving-ization, it can low-cost-ize.

[0035]The anode of the diode 21 which constitutes the rectification smoothing circuit 20 of the above-mentioned output line from circuitry of the case shown in drawing 1, Although common connection of the anode of the diode 41 which constitutes the rectification smoothing circuit 40 provided independently [the rectification smoothing circuit 20 of the above-mentioned output line] was carried out to the secondary coil 10B of the above-mentioned converter transformer 10, It may be made to connect with the tap-out T1 and T2 which provide the tap-out T1 and T2 in the secondary coil 10B of the above-mentioned converter transformer 10, and are different in a node of each diodes 21 and 41, as shown in (A) of drawing 2, or (B).

[0036]

[Effect of the Invention]In the charge circuit which carries out rectification smoothness of the output of a switching regulator, and charges a rechargeable battery in this invention as explained above, The charge voltages supplied to a rechargeable battery from the above-

mentioned switching regulator by a charging voltage control circuit based on the output of the voltage detection means which detects the voltage between the terminals to which the above-mentioned rechargeable battery is connected are controlled, The switch element by which the series connection was carried out to the power supply line between the terminals to which the above-mentioned rechargeable battery is connected is controlled, when the input power of the above-mentioned switching regulator is one, it is considered as switch-on, and when this input power is OFF, it is considered as non-switch-on. When the input power of the above-mentioned switching regulator is OFF, and the above-mentioned switch element will be in non-switch-on, the driving source line of the above-mentioned voltage control circuit is intercepted, and the back run current from the above-mentioned rechargeable battery to the above-mentioned voltage control circuit does not flow.

[0037]When the input power of the above-mentioned switching regulator is one, When the above-mentioned switch element will be in switch-on, the above-mentioned voltage control circuit operates by using the output of the above-mentioned switching regulator as a driving source, Since the driving current of the current which flows into the dummy resistor of the above-mentioned conventional example flows into the above-mentioned voltage control circuit, even when load changes suddenly, in a load drive state, fault by quenching of a PWM controlling circuit is not produced. That is, in the circuitry of the case, the conventional dummy resistor can be omitted, a part for the power consumption by a dummy resistor and power consumption can be lessened, and power consumption at the time of standby can be lessened.

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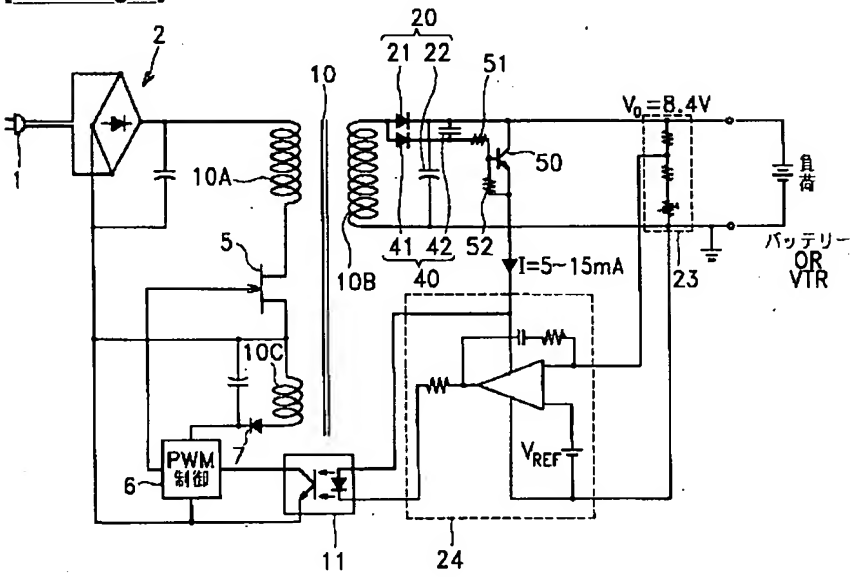
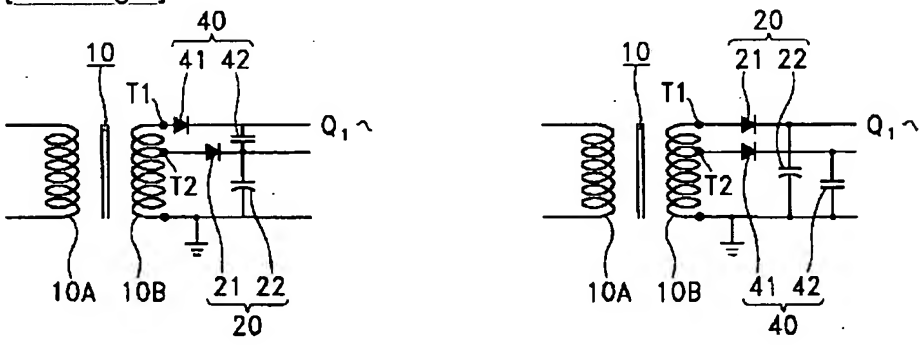
DRAWINGS

[Drawing 1]

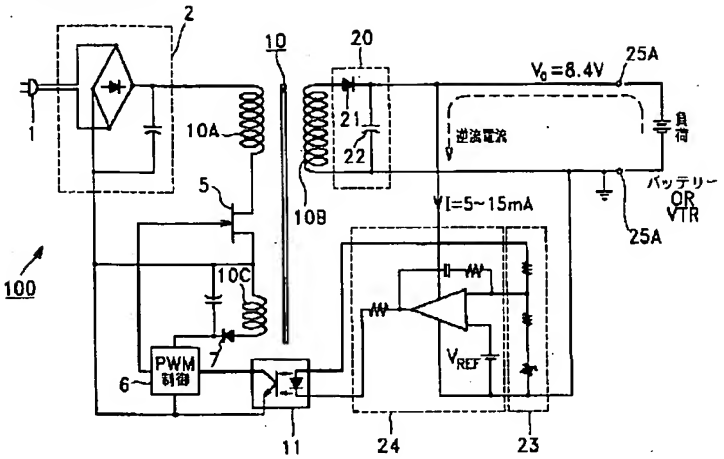


[Drawing 2]

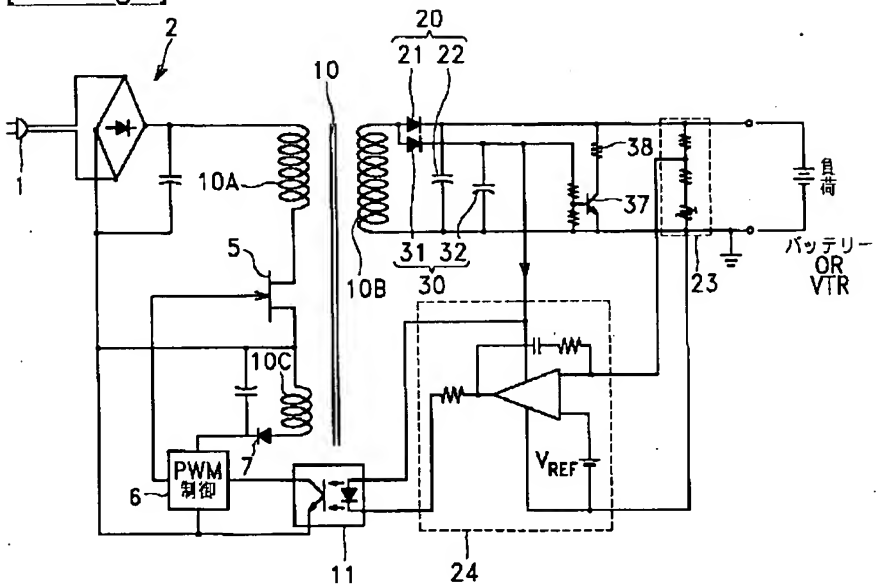


(A) (B)

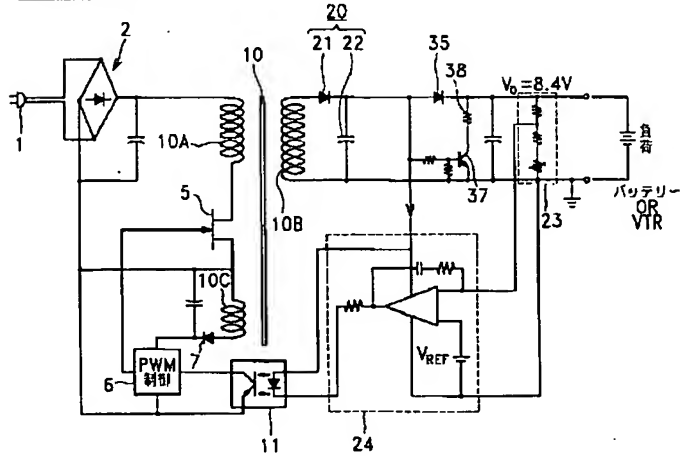
[Drawing 3]



[Drawing 4]



[Drawing 5]



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